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The Cultivation of Medicinal Plants.

(Address of the retiring president, fifty-first annual meeting.)

L. D. HAVENHILL.

Members of the Kansas Academy of Science, Ladies and Gentlemen: It is not of my own volition, but to comply with a by-law of this Academy, adopted more than a generation ago, that I appear before you this afternoon.

Nearly twenty-five years ago, when the Academy met at this College, Professor Sayre, dean of the school of pharmacy of the State University, as your president, addressed you on the subject of "Medicinal Plants." Now, after a lapse of nearly a quarter of a century, and the Academy again assembled in Manhattan, another member of the faculty of the same school of pharmacy is about to speak to you on a kindred subject, "The Cultivation of Medicinal Plants."

Professor Sayre has been from the very first an ardent advocate of the cultivation of medicinal plants in the United States, and particularly in Kansas. The seeds sown by him have as yet failed to germinate in Kansas, though, strange to say, those wafted into the adjoining states both to the north and to the south have rooted, blossomed and fruited.

Medicinal plants have always afforded a subject of great interest, and their cultivation dates back many centuries before the Christian era. Drug cultivation in the United States as a whole, aside from those plants which serve two purposes—medicinal and industrial—and in which value as a drug is the least important, have received but little attention. In this class are such plants as cotton, tobacco, flax, hemp, hops, mustard, castor beans, etc. The explanation for this lack of more general consideration may, of course, be found in the limited and sometimes uncertain market for drugs; the easily accessible supplies, under normal conditions, from foreign countries; the lack of knowledge in their cultivation; and the cost of labor.

The recent strenuous times have brought to us a lesson on the desirability of developing our own resources more evenly in all directions. The question now is, Will we profit by it, or will we again drift back into the old, easy channels?

In the past if some nation by reason of her more frugal habits was able to develop a certain line of industry and supply our needs at a price below that at which we could produce the same goods and at the same time realize a profit commensurate with that obtainable in other lines, we were content to have her do so. Profit seems ever to have been the prime incentive for the development of our industries, and the greater the profit the greater has been the development.

The rapid production of various synthetic drugs of foreign manufacture, together with skillful advertising, has resulted in the undoing of our one-time favorite herb doctor with his store of remedies derived from the vegetable world, and particularly from his own garden. The demand for these foreign synthetics has enormously increased, while that for our local drugs has materially declined. The vegetable materia medica has become greatly narrowed, and, strange to say, that which remains of it is largely foreign grown. It was, therefore, to be expected, when ocean commerce began to be interrupted and

the great drug markets of the world—Hamburg, Trieste and London—practically closed, that a marked drug scarcity was experienced in this country, and that the prices of all drugs should advance from ten to several hundred per cent. This shortage in some instances became very acute, and but for the foresight of certain individuals might have become extremely serious.

Drug cultivation, while not entirely new in this country, has, for reasons already mentioned, never flourished here. What has been done has been largely in the way of experimental gardening rather than farming.

Our supply of native American drugs has until recently been derived almost entirely from wild plants. Strange to say, in spite of our large medicinal flora, but one plant, ginseng, has up to the present attained any importance in our exports, and but few of our native plants have attracted any attention abroad. On the other hand, we have been importing between fifteen and twenty million dollars' worth of drugs annually, of which a considerable part could be raised in this country, while no inconsiderable quantity might be collected from plants flourishing here, and which in some cases are considered as pests. This is particularly true of drugs such as dandelion, yellow dock, poke, burdock, jimson, corn silk, red-clover blossoms, etc.

The time when the cultivation of drugs began in America does not seem to be recorded. The early settlers are known to have brought seeds with them from Europe, and many of the plants so introduced have, like the people who brought them, become naturalized and spread to the four corners of the country. We have visible and lasting evidences of this in several well-known plants, particularly in dandelion and stramonium. The last-named plant, commonly known as jimson weed—a contraction of Jamestown weed—thereby has its origin in this country definitely fixed.

History furnishes but little information concerning the cultivation of drugs in this country prior to the beginning of the nineteenth century. In 1781 we find that Marshall attempted the cultivation of the opium poppy. In passing it might be stated that the cultivation of this plant is not difficult. It has been found to thrive in various parts of the United States and as far north as Vermont. A very fair quality of opium can be produced, but the amount of hand labor required is too great to enable us to compete with the Old World. We must wait for the production of our own morphine and codeine until we can derive it more directly from the plant. The United States Department of Agriculture has recently reported some progress in this direction.

The Shakers were the first people in this country to engage in what might be called extensive operations in drug cultivation. They began it at Mount Lebanon, N. Y., as early as 1800, and soon established quite a business. Other Shaker colonies subsequently took up the work, particularly at Union Valley, Ohio. One of these companies is said to have had at one time at least forty acres under cultivation. The annual production of drugs at Mount Lebanon when the industry was at its height is estimated at from 40,000 to 50,000 pounds. The work of the Shakers in this direction in recent times, particularly since 1880, has attracted but little attention.

One of the oldest medicinal plants in the world is mint. It was likewise one of the first to receive attention commercially in America. The production of oil of peppermint was begun in Wayne county, New York, in 1816, and soon reached sufficient importance to rate this county as one of the mint-producing

centers of the world. The cultivation extended to Michigan in 1835, and since then this state, owing to better soil and improved methods, has passed to the first rank. Mint growing is now a well-established industry in New York, Michigan and northern Indiana. The states Iowa, Wisconsin, Idaho, Oregon, Illinois, and quite recently Louisiana, contribute, but to a much lesser extent. It is believed that peppermint would do well on some of the rich bottom lands of Kansas. The profits to be derived from mint culture are said to be in the same class as alfalfa growing, but the market for the output is very much more limited and the industry could soon be overdone. The expense of planting, providing stills, etc., is also quite great. An acre of mint will produce from 12 to 50 pounds of oil, worth from \$2 to \$3 per pound.

Ginseng, the first of our native drugs to be exported, and indeed about the only one still, was not one of the first to be cultivated. Until about 1885 it was believed to be impossible of cultivation, though the suggestion of its cultivation was made as far back as 1801 by Samuel Stearns in his *American Herbal*. The exportation of this drug is recorded in 1794, and official figures for 1821 show that 362,992 pounds were exported, averaging 48 cents per pound and valued at \$171,586. In 1887 the average price per pound had risen to more than \$2, yet its cultivation was regarded as doubtful and unprofitable by the United States Department of Agriculture.

The first successful cultivation of this plant, according to an article by Forrest Crissey, published in *American Forestry* for 1913, is attributed to a Missourian, who inspired by the adverse reports of the Department of Agriculture, determined to "show the government." So successful was his demonstration that it is claimed that the returns from his little garden nine years later amounted to \$25,000, and that shortly afterwards he was offered \$100,000 for his ginseng patch of a quarter acre. A ginseng boom was started along about 1903, and, as was to be expected, a great many people lost all that they put into this venture. Others more skillful and persistent had made it pay. Most of the supply of this drug is exported to China. The statements frequently quoted that it is of value only because of the fancied resemblance to the human form do not appear to be founded on fact, judging from the type of drug most in demand, which is the plain, finely wrinkled root that would be chosen by any drug expert as possessing the greatest medicinal value. This drug is now successfully cultivated in several states of the Union. Owing to its high price, the supply of the wild drug is practically exhausted. The tonnage exported has fluctuatingly decreased almost from the beginning, but the price, on the other hand, has increased more than proportionately. The records show that the largest exportation was 640,967 pounds, in 1841; the smallest 37,491 pounds, in 1854. The lowest average price per pound was 30 cents, in 1825, and the highest \$8.16, in 1914. The total number of pounds exported in 1914 was 224,605, valued at \$1,832,682. This, by the way, is the record in total value as well as in price per pound. In recent years disease has attacked the gardens to such an extent as to demand expert treatment. This has rendered the commercial cultivation of this plant more highly specialized and the monetary returns more uncertain than ever before. The long time required to mature a crop—five to six years—together with the appearance of disease, seems certain to restrict the cultivation of this plant in the future to those who are greatly interested in and thoroughly qualified for the work.

This will tend to prevent overproduction, and in a measure maintain the con-

tinued high price, thus insuring to these few adequate financial returns for their labors.

Many of those of the less fortunate ginseng growers are already turning their attention to the cultivation of another and much harder plant, *hydrastis*, or golden seal, which requires about the same general treatment. Golden seal also requires four or five years in which to mature a crop. The supply of this drug is limited at present to the wild plants, which are found growing chiefly in the valley of the Ohio river. The bulk of these plants are now literally eradicated. The price of this drug, which in 1895 was only 15 cents per pound, has now for several years ranged between \$4 and \$5. Those who are possessed of producing gardens are reaping a rich harvest. There is no question whatever in medical circles concerning the therapeutic value of golden seal. The market, though still largely a home one, is gradually extending to Europe. The danger of overproduction is not immediate, and it would therefore seem that for those who possess limited acres but limitless patience, and who are living in localities where the natural conditions of climate and soil are favorable, the cultivation of this drug offers a remunerative field.

Two other native drug plants of worth which are also becoming quite scarce are *senega* and *cascara sagrada*. Unless we are able to find substitutes for them their cultivation will soon become imperative.

The United States Department of Agriculture has in recent years been devoting considerable time and attention to the cultivation of medicinal plants, and in particular to those plants for which we are dependent upon other nations. One of the first of these to receive the attention of the department was the camphor tree. Camphor, though widely known and used, is only about two-thirds the commercial importance of ginseng. The imports in 1914 amounted to 4,043,014 pounds, worth \$1,112,505. It is said that about two-thirds of the amount imported is consumed in the manufacture of celluloid. The world's supply of camphor is obtained from China and Japan. During the Russian-Japanese War the supply of camphor became so uncertain and the price so high as to seriously interfere with the celluloid industry. This resulted in the stimulation of the production of synthetic camphor, and also in causing the United States Department of Agriculture to advocate the cultivation of the camphor tree in this country, especially in Florida and southern California. The department has been very successful in its experiments as well as in engaging private capital in this enterprise. There are now quite extensive plantations in Florida and also in the island of Jamaica. More economical methods of harvest than those used in the Orient have been employed, and the present indications are that we will soon be producing camphor in sufficient amounts for our needs. It is recommended that the trees be planted in a kind of hedge, so that they can be trimmed by machines once or twice a year. The camphor is obtained by distilling the leaves and twigs, which are found to be richer in oil and "gum" than the wood, and, of course, this method, unlike the Oriental method, is not destructive to the trees. There are now more than eighteen square miles of camphor plantations in Florida.

Other well-known drugs for which we have until quite recently depended entirely upon other countries for our supply are *belladonna*, *hyoscyamus*, *digitalis* and *cannabis*. These are now being successfully grown in the United States, though still in very limited quantities.

The introduction of belladonna culture is due to Dr. F. B. Kilmer, of the firm of Johnson & Johnson, famous for belladonna plasters. The experiments were begun in the Belleview gardens of Mr. R. W. Johnson, president of the firm, in 1899. Since then its cultivation has extended into several states. The most elaborate experiments, perhaps, have been those conducted in California under the direction of Prof. Albert Schneider, of the California College of Pharmacy. The annual demand for this drug is estimated at between 300 and 400 tons. The average yearly yield per acre is variously stated, but a safe average would undoubtedly be about one ton. It will thus be readily seen that between 300 and 400 acres is all the territory that we need devote to this industry. This acreage will undoubtedly soon be under cultivation. Concerning the financial returns to be derived from the cultivation of this drug, it is stated that the first few pounds of it raised cost the firm of Johnson & Johnson more than \$1,000 each. The market price of the drug is now about \$1.75 per pound. One advertiser claims to have received \$2,400 per acre for his crop.

Our nation recently experienced a marked shortage in digitalis, which for a time threatened to be serious. The school of pharmacy of the University of Minnesota has for several years been especially active in the propagation of digitalis, and when the shortage began to be felt this university announced that it had enough of the drug on hand to meet the needs of the people of Minnesota. The United States government called upon this institution for digitalis, and it in turn called upon other institutions for aid. The school of pharmacy and the peoples of the states of Oregon and Washington responded and collected quantities of this drug, which thrives without cultivation in the ranges near the Pacific in a strip of territory about forty miles wide and ranging from northern California through Oregon and well up into Washington. The school of pharmacy at Cornwallis forwarded to the receiving and testing station at the University of Minnesota some 1,600 pounds of choice dried drug, while from another small district in the state some 15 tons of it were collected. It is estimated that the Oregon territory alone can furnish 50 tons of digitalis annually, and of as good or better quality than that received in recent years from gardens in England. The annual import of this drug is claimed to be between 40,000 and 60,000 pounds.

By taking into account our various natural resources, it would seem that with a minimum amount of attention the greater part of our requirements in the way of vegetable drugs could in the future be easily taken care of through home production. Some steps in this direction have already been taken and a movement has been started to establish an institute for coöperative research as an aid to the American drug industry.

At the present time the cultivation and propagation of medicinal plants in the United States is being carried on in a more or less unorganized way by the following:

1. Manufacturers of drug products, such as the firms of Johnson & Johnson, New Brunswick, N. J.; H. K. Mulford & Co., Philadelphia, Pa., and Eli Lilly & Co., Indianapolis, Ind. The first-mentioned firm may be considered as the pioneer. This firm has devoted its efforts particularly to the cultivation of belladonna. The other firms have undertaken a wider field and have also achieved measurable success.

2. Botanical gardens, such as the Botanical Garden of New York, the Shaw

Botanical Gardens of St. Louis, the Philadelphia Botanic Gardens, and the gardens of the United States Department of Agriculture. The Department of Agriculture, through the Bureau of Plant Industry, has done and is doing a great amount of experimental work in the growing of economic plants in general, a goodly number of which are medicinal.

3. Various schools of pharmacy. Many of these have seriously engaged in the cultivation, and especially the propagation, of medicinal plants, and several of them have made considerable progress. Conspicuous in this group are the state schools of Michigan, Wisconsin, Minnesota and Nebraska.

4. Various seed and nursery firms.

5. Private gardeners, representing varying amounts of capital in the different states.

Though Professor Sayre was one of the first to advocate drug propagation as an essential part of the work of a school of pharmacy, Kansas has been slow to respond and has not taken a prominent part in this work. Some financial assistance has at last been granted, and he hopes to begin some of this work in the very near future.

A review of the flora of Kansas discloses that there are growing within the borders of the state between 300 and 400 plants to which medicinal properties have been attributed. In this list there are but few species of recognized importance, and practically none of these are found growing in sufficient abundance to be of commercial importance to the state.

So far as I have been able to ascertain, ginseng is the only drug not native to the state that has been cultivated here, and that with indifferent success. Of the native plants the one of greatest importance is the echinacea, the natural range of which centers in Kansas and Nebraska. This drug is a very popular alterative, and many physicians, in spite of the adverse reports concerning its medicinal value from the laboratory of the American Medical Association, continue to prescribe it with gratifying results. The cultivation of this plant is recommended if the supply is to be maintained. It is quoted at 24 cents per pound. Whether its cultivation will prove remunerative at that figure remains to be proven. The proper place for settling this question would certainly seem to be in Kansas or Nebraska. Silphium—rosin weed—is another drug which is supplied to some extent from Kansas. It is quoted at 4 cents per pound for the root. There are several drugs that grow so persistently here that it would seem that their cultivation might be profitable. One of these is dandelion, which is quoted at 21 cents per pound. There are many other and more valuable exotic drugs which might flourish in Kansas were they but once introduced.

While it is believed by many that drug cultivation, on the whole, will not prove to be any more profitable than the growing of other field and garden products, this is no excuse for neglecting to produce so important an article. By improving the species and methods of harvesting, which has been done in almost every instance in which the subject has received attention, much may be accomplished in the way of discouraging foreign competition and increasing the financial returns. Attention should also be paid by the pharmacist and chemist to the preparation of drug concentrates, which, as in the case of such drugs as dandelion, would undoubtedly yield valuable returns and bring the drug itself into a more useful and favorable condition for therapeutic employment.

This entire field should and must be covered. It is almost entirely unexplored at present, and surely it presents an inviting opportunity for research to those who love to grow plants. We should, if for nothing more than as a matter of duty, take up this work seriously in the very near future and produce for our own use such drug plants as can be grown in our ranges of climate.

Many of the older members of this Academy have in times past displayed considerable interest in this subject, though in recent years we have heard but little from them concerning it. I wish to take this opportunity to invite them to continue this work and also to invite the younger members of the Academy to give it careful consideration, in the hope that before another quarter of a century rolls around Kansas, through her Academy of Science, will have been placed on the map.

In concluding, a series of lantern slides illustrating certain phases of this work were shown.

Patent Laws in Regard to the Protection of Chemical Industry.

L. E. SAYRE.

At the time of the last meeting of this Academy chemical manufacturers and many captains of our industries were facing a serious problem of supplies due to war conditions. The situation brought into prominence some questions relating to our patent and copyright laws which had a more or less direct influence upon the stimulation of home production, self-dependence, the stimulation of invention, research, etc. Our laws with reference to this subject, it was believed, needed revision. A rather informal discussion of this subject took place at our annual meeting, which suggested the presentation of the present paper in the hope that, now the war is over, the subject may be still kept alive and some deliberate legislation may be finally obtained which will tend to further the aim above referred to.

There are at least two distinct methods our government has recognized to promote research and invention; one is by subsidy, and the other by patent, trade-mark laws, etc. As a recent example of subsidy, we may cite the appropriations made by Congress for experimental purposes. From the *Congressional Record* we note that for aviation purposes the third session of the Sixty-first Congress, 1911, appropriated \$25,000, and in the second session of the Sixty-second Congress, 1912, \$20,000; the Sixty-third Congress, 1914, \$10,000. Since the first session of the Sixty-fourth Congress, there was appropriated from public funds for aviation purposes over \$50,000,000, a large part of which may be considered as subsidy for research and invention.¹

In every age progress has been obstructed and the beneficent work of inventors set back for a generation by the general apathy and the utter lack of public encouragement and recognition. Who can estimate the incalculable public advantage, the benefits redounding to the general welfare, to industrial progress and the steady advance of science and the arts had the government promptly and generously assisted, by subsidy, in the development and promotion of such epochal inventions as the spinning jenny (1769), the power

1. *Congressional Record*, vol. LV, p. 5129.